What is claimed:

1. An arrangement for use in an optical metrology instrument where light is detected and analyzed after reflecting from a measurement position on a sample comprising:

an optical system connected to a support, the support including a faceplate having an exterior surface that is substantially planar and faces the sample, said faceplate further including at least one aperture for transmitting the incident and reflected light between the optical system and the measurement position;

a stage arranged such that the sample surface is substantially parallel to the faceplate and configured such that multiple locations on the sample surface can be sequentially located at the measurement position, the separation between the faceplate and the sample being arranged such that during measurement the volume bounded by the faceplate and the sample surface approximates a thin plate; and

an apparatus for maintaining a purge-gas flow within said bounded volume, comprising:

a source of purge-gas; and

means for introducing said purge-gas at an injection point within the bounded volume and arranged so that a purge gas flow travels past the measurement position to improve the measurement.

2. The arrangement of claim 1 where the optical metrology instrument includes one or more elements selected from the group consisting of reflectometers, ellipsometers, polarized beam reflectometers, scatterometers and optical CD metrology instruments.

3. The arrangement of claim 1 where the optical system contains at least one element selected from the group consisting of transmissive, reflective, diffractive and polarizing optics.

4. The arrangement of claim 1 where said aperture further contains at least one substantially transparent optical element for the purpose of isolating said system optics from said bounded volume.

5. The arrangement of claim 4 where said substantially transparent optical element is fabricated from at least one optical material selected from the group consisting of fused silica, fluorine-doped fused silica, quartz, CaF_2, SrF_2, BaF_2, MgF_2, LaF_3 and LiF.

6. The arrangement of claim 1 where the purge-gas is selected to be substantially non-absorptive over the wavelength range of the light employed in the optical metrology instrument.

7. The arrangement of claim 1 where the purge-gas is selected from the group consisting of helium, argon and nitrogen.

8. The arrangement of claim 1 where said source of purge-gas is selected from the group consisting of compressed gases and cryogenic liquids.

9. The arrangement of claim 1 where said purge-gas is introduced above atmospheric pressure.

10. The arrangement of claim 1 where the separation between the faceplate and sample surface during measurement is selected to minimize the time required to purge that portion of the bounded volume surrounding the measurement position.

11. The arrangement of claim 1 where the separation between the faceplate and the sample surface during measurement is in the range between 10μm and 2 mm.

12. The arrangement of claim 1 wherein said means for introducing the purge gas includes at least one fluid channel formed in the faceplate and communicating with the source of purge gas, said fluid channel having an outlet adjacent to the measurement

position so that the flow path is established in the bounded volume adjacent the measurement position and radially outwardly therefrom.

13. A method for gas-purging an optical metrology instrument that measures the changes in incident illumination produced by interaction with and reflection from a sample at a measurement position, said instrument including system optics mounted to a support, said support including a faceplate separating the system optics from the sample to be measured, said faceplate having a planar surface and at least one aperture for the purpose of transmitting incident and reflected light between the sample and the system optics at said measurement position, said instrument further including a stage for supporting the sample below the optics plate, said method comprising the steps of:

establishing a flow of purge-gas below the optics plate;

raising the sample stage to said measurement location such that the volume bounded by the faceplate and sample approximates a thin plate, said flow of purge-gas traveling through said bounded volume and passing the measurement position;

illuminating the sample at said measurement position; and

detecting and analyzing the illumination following reflection from and interaction with the sample at said measurement position.

14. The method of claim 13 where said aperture further contains at least one substantially transparent optical element for the purpose of isolating said system optics from said bounded volume.

15. The method of claim 14 wherein said at least one substantially transparent optical element is fabricated from at least one optical material selected from the group consisting of fused silica, fluorine-doped fused silica, quartz, CaF_2, SrF_2, BaF_2, MgF_2, LaF_3 and LiF.

16. A method of claim 13 wherein the optical metrology instrument includes at least one element selected from the group consisting of reflectometers, ellipsometers, polarized beam reflectometers, scatterometers and optical CD metrology instruments.

17. The method of claim 13 where the incident illumination originates from at least one light source selected from the group consisting of broad-band and narrow-band light sources.

18. The method of claim 17 where the broad-band and narrow-band light sources are selected from the group consisting of incandescent, discharge, amplified stimulated emission and laser sources.

19 The method of claim 17 where the incident illumination spans at least a portion of at least one of the extreme ultra-violet, deep ultra-violet, ultra-violet, visible, near infra-red and infra-red spectral ranges.

20. The method of claim 13 where the system optics contain at least one element selected from the group consisting of transmissive, reflective, diffractive and polarizing optics

21. The method of claim 13 where the purge-gas is selected to be substantially non-absorptive over the wavelength range of the illumination employed in the optical metrology instrument.

22. The method of claim 13 where the purge-gas is selected from the group consisting of helium, argon and nitrogen.

23. The method of claim 13 where the purge-gas source is selected from the group consisting of compressed gases and cryogenic liquids.

24. The method of claim 13 where said purge-gas is introduced above atmospheric pressure.

25. The method of claim 13 where the separation between the faceplate and sample surface at said measurement location is selected to minimize the time required to purge the bounded volume.

26. The method of claim 13 where the separation between the faceplate and the sample surface at said measurement location is in the range between 10 μm and 2 mm.

27. The method of claim 13 where the purge-gas is introduced into the bounded volume adjacent the measurement position with said purge gas traveling radially outwardly therefrom.

28. An apparatus for evaluating characteristics of a sample comprising:

a light source for illuminating a sample;

an optical system mounted to a support, said support including a faceplate, with an exterior surface that is substantially planar and faces the sample, said faceplate further including at least one aperture for the purpose of transmitting the incident and reflected light from the source between the optical system and the measurement position;

a stage arranged such that the sample surface is substantially parallel to the planar faceplate and with the separation between the faceplate and the sample being arranged such that during measurement the volume bounded by the faceplate and the sample surface approximates a thin plate;

an apparatus for maintaining a purge-gas flow within said bounded volume, comprising:

a source of purge-gas; and

a conduit for introducing said purge-gas at an injection point within the bounded volume adjacent the measurement position;

a detection system for monitoring light reflected from the sample and generating output signals in response thereto; and

a processor for evaluating the characteristics of the sample based on the detected output signals.

29. The apparatus of claim 28 where the light source is selected from at least one element from the group consisting of broad-band and narrow-band light sources.

30. The apparatus of claim 28 where the emission spectrum of the light source spans at least a portion of at least one of the extreme ultra-violet, deep ultra-violet, ultra-violet, visible, near infra-red and infra-red spectral ranges.

31. The apparatus of claim 28 where light source includes at least one element selected from the group consisting of incandescent, discharge, amplified stimulated emission and laser sources.

32. The apparatus of claim 28 where the detection system includes at least one element selected from the group consisting of reflectometers, ellipsometers, polarized beam reflectometers, scatterometers and optical CD metrology tools.

33. The apparatus of claim 32 wherein the detection system is selected from the group consisting of: spectroscopic reflectometers for measuring the change in magnitude of the radiation at a plurality of wavelengths and spectroscopic ellipsometers for measuring the change in polarization state of the radiation at a plurality of wavelengths.

34. The apparatus of claim 33 wherein the detection system is a polarized beam spectroscopic reflectometer for measuring the change in magnitude of polarized radiation at a plurality of wavelengths.

35. The apparatus of claim 28 wherein the detection system and processor operate to analyze, individually or in combination, output signals selected from the group consisting of: the change in magnitude of the radiation at a plurality of wavelengths, the change in polarization state of the radiation at a plurality of wavelengths, the change in magnitude of polarized radiation at a plurality of wavelengths.

36. The apparatus of claim 28 where the purge-gas is selected to be substantially non-absorptive over the wavelength range of the light employed in the optical metrology instrument.

37. The apparatus of claim 28 where the purge-gas is selected from the group consisting of helium, argon and nitrogen.

38. The apparatus of claim 28 where the purge gas is supplied by one or more elements selected from the group consisting of compressed gases and cryogenic liquids.

39. The apparatus of claim 28 where the purge-gas is introduced above atmospheric pressure.

40. The apparatus of claim 28 where the separation between the faceplate and sample surface is selected to minimize the time required to purge that portion of the bounded volume surrounding the measurement position.

41. The apparatus of claim 28 where during measurement the separation between the faceplate and the sample surface is in the range between 10μm and 2 mm.

42. The apparatus of claim 1 wherein said means for introducing the purge gas includes at least one fluid channel formed in the faceplate and communicating with the source of purge gas, said fluid channel having an outlet adjacent to the measurement position so that the flow path is established in the bounded volume adjacent the measurement position and radially outwardly therefrom.

43. An arrangement for use in an optical metrology instrument where light is detected and analyzed after reflecting from a measurement position on a sample comprising:

an optical system mounted to a support, said support including a faceplate having an exterior surface that is substantially planar and faces the sample, said faceplate further including at least one aperture for transmitting the incident and reflected light between the optical system and the measurement position, said faceplate further including a fluid channel having an output adjacent the aperture;

a stage arranged such that the sample surface is substantially parallel to the faceplate and configured such that multiple locations on the sample surface can be sequentially located at the measurement position, the separation between the faceplate and the sample being arranged such that during measurement the volume bounded by the faceplate and the sample surface approximates a thin plate; and

a source of inert purge-gas coupled to the fluid channel of the faceplate for establishing a flow of purge gas past the measurement position and within the bounded volume to improve measurement.

44. An inspection module for use in an optical metrology device, said metrology device including a source for generating a probe beam of radiation that is directed to a spot on a semiconductor wafer, said module comprising:

a top plate having a planar bottom surface and an aperture configured to permit the probe beam to pass therethrough from the upper surface thereof, said top plate further including a fluid channel having an inlet and an outlet, with the outlet being located near the position on the wafer to be measured by the probe beam;

a translatable bottom plate having a planar top surface for supporting the wafer and being movable from a lower loading position to an upper measuring position, and wherein when the bottom plate is in the upper measuring position a

narrow gap is defined between the upper surface of the wafer and the lower surface of the top plate; and

a source of inert purge gas coupled to the inlet of the fluid channel and wherein said channel is configured such that when said purge gas is passed therethrough a flow path is established in the gap across the measurement spot on the wafer and radially outwardly therefrom to improve measurement.

45. An inspection module as recited in claim 44 wherein said aperture is sealed with an optical element substantially transparent to the probe beam radiation.

46. A method of optically inspecting a semiconductor wafer with a metrology tool, said tool including a stage for supporting a wafer below a planar optics plate, said planar optics plate including at least one aperture for allowing a probe beam generated from a light source located above the optics plate to illuminate and reflect off the wafer at a measurement position, said method comprising the steps of:

positioning the stage with respect to the optics plate so a narrow gap is defined between the bottom surface of the optics plate and the upper surface of the wafer;

injecting a purge gas into the narrow gap adjacent the measurement position; and

optically inspecting the wafer at the measurement position with the probe beam.

47. A method as recited in claim 46 wherein said step of injecting purge gas is initiated prior to the positioning step.

48. A method as recited in claim 46 wherein said purge gas is injected into the narrow gap through a fluid channel formed in the optics plate.

49. A method as recited in claim 26 wherein the purge gas is injected adjacent the measurement position and flows radially outwardly therefrom.

50. An apparatus for evaluating characteristics of a sample comprising:

a light source for illuminating a sample;

a support structure, said light source being connected to the support structure, the support structure including a faceplate, with an exterior surface that is substantially planar and faces the sample, said faceplate further including at least one aperture for the purpose of transmitting the incident and reflected light from the measurement position;

detector connected to the housing for monitoring light reflected from the sample and generating output signals in response thereto;

a first hollow member through which light from the source is channeled to the aperture in the face plate;

a second hollow member through which light reflected from the sample is channeled from the aperture in the face plate to the detector;

a stage arranged such that the sample surface is substantially parallel to the planar faceplate and with the separation between the faceplate and the sample being arranged such that during measurement, the volume bounded by the faceplate and the sample surface approximates a thin plate; and

a source of purge-gas, said purge gas being directed through the hollow members and also introduced within the bounded volume adjacent the measurement position so that substantially all of the light path between the light source and the detector is purged.

51. The apparatus of claim 49 where the purge-gas is selected to be substantially non-absorptive over the wavelength range of the light employed in the optical metrology instrument.

52. The apparatus of claim 49 wherein face plate includes at least one fluid channel communicating with the source of purge gas, said fluid channel having an outlet adjacent to the measurement position so that the flow path is established in the bounded volume adjacent the measurement position and radially outwardly therefrom.

53. A method for gas-purging an optical metrology instrument that measures the changes in incident illumination produced by interaction with and reflection from a sample at a measurement position, said instrument including system optics mounted to a support, said support including a faceplate separating the system optics from the sample to be measured, said faceplate having a planar surface and at least one aperture for the purpose of transmitting incident and reflected light between the sample and the system optics at said measurement position, said instrument further including a stage for supporting the sample below the optics plate, said method comprising the steps of:

establishing a flow of purge-gas below the optics plate adjacent the aperture;

raising the sample stage to said measurement location such that the volume bounded by the faceplate and sample approximates a thin plate, said flow of purge-gas traveling through said bounded volume radially outwardly from the measurement position;

illuminating the sample at said measurement position; and

detecting and analyzing the illumination following reflection from and interaction with the sample at said measurement position.

54. The method of claim 53 where said aperture further contains at least one substantially transparent optical element for the purpose of isolating said system optics from said bounded volume.

55. The method of claim 53 where the purge-gas is selected to be substantially non-absorptive over the wavelength range of the illumination employed in the optical metrology instrument.